May 1991

BEST PRACTICE PROGRAMME

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Energy Consumption Guide

ENERGY EFFICIENCY IN OFFICES

Energy Consumption Guide for Senior Managers

The aims of this document are to:

- **Increase awareness of energy costs in offices**
- **show the main areas of cost**
- **indicate what can be achieved, by comparison with others**
- **suggest areas in which action can be taken.**

Introduction

Energy efficiency is important. It is important because it can save you money — typically 20% of energy costs. And it is important because it helps the environment by reducing gaseous emissions responsible for acid rain and the greenhouse effect.

All offices need energy to provide heating, hot water, lighting, power and, where provided, air conditioning. The energy used for these purposes accounts for over £880 million every year in the UK. Wasteful office buildings, whether poorly designed or badly run, can use as much as ten times more energy than similar efficient buildings.

This Guide introduces a significant, but easy to use, energy performance indicator. It allows you to compare the energy performance of your office with others, simply and quickly. The indicator is energy cost per unit gross floor area, and it's as simple as that.

BRECSU (the Building Research Energy Conservation Support Unit) is a specialist unit which manages buildings-related technical R&D, marketing and promotional programmes, for the Energy Efficiency Office (EEO). BRECSU has gathered information on energy use in a wide range of different offices. This shows the annual energy cost (fossil fuel plus electricity) per square foot (gross) in these offices. You can compare your office's energy costs with this range of figures and assess your office's performance in broad terms. If you use costs per square metre, multiply the cost per square foot figures by 10 for an approximate conversion.

In addition, more comprehensive information on significant energy uses is available for a number of the offices in the total sample. This allows you to look at energy use in greater detail. Some of the offices are "Good Practice Case Study" offices, investigated under the EEO's Best Practice programme. These properties feature a number of energy efficiency measures. They are generally at the lower end of the scale of energy costs per square foot, demonstrating just what savings can be achieved by greater attention to energy efficiency.

If your office compares badly, then you should consider taking measures to reduce energy consumption. If it compares well, congratulations — but there may still be more you can do. Why not take the opportunity to seek additional ways of improving performance.

Energy Efficiency Office
DEPARTMENT OF ENERGY

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How to use The Guide

The information is presented in a number of graphs showing details of annual energy cost at 1990 prices per square foot of gross floor area. You should be able to get hold of your energy bills (you will need a whole year's set of bills for all fuels and electricity) and details of the size of your office easily. Simply calculate the key indicators for your offices and compare them with the graphs.

Total Energy Costs

Figure 1 shows total annual energy costs per square foot (£/ft²) of floorspace for the offices in the sample, ranging from £4.43/ft² to £0.26/ft². The majority of offices are in the mid range £0.50-1.50/ft², which is a good performance relative to the maximum.

However, there is still scope for improvement for these offices. Consider a building with energy costs of £1.25/ft². It is possible to reduce this by 50% and still be above the minimum of £0.26/ft².

The aim of implementing energy efficiency measures is to reduce energy costs and so move total building energy costs per square foot to the right along the horizontal axis, to a lower cost per square foot. This has been achieved in the Good Practice Case Study offices. In the majority, energy consumption is less than £1.00/ft², with only 2 above the mid range of £0.50-1.50/ft². (Those with high energy costs have a computer suite with a high energy consumption — see page 4). They demonstrate that attention to energy efficiency in the design and running of offices can lead to reduced energy bills.

How is this achieved? First, let's look at some of the major components of office energy use.

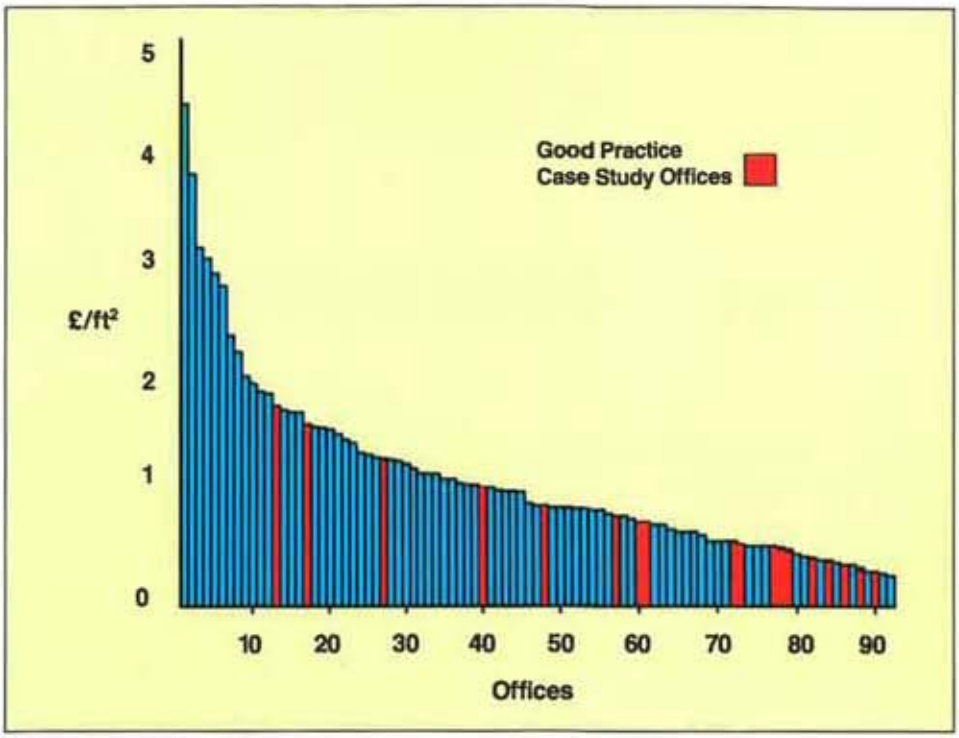

Figure 1 Total energy costs

Impact of Air Conditioning

It is widely recognised that air conditioning can have a major impact on building energy costs. This is supported by Figure 2, which shows the extent of air conditioning installed in each of the buildings in the sample. In most cases, the very lowest energy consumers are naturally ventilated or only partially mechanically ventilated offices.

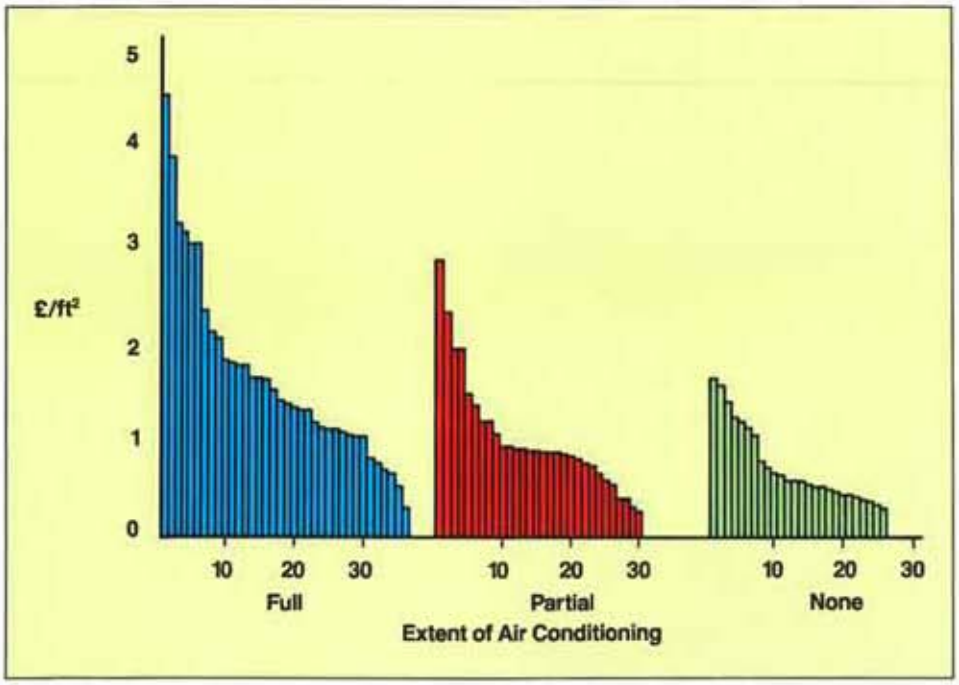

Figure 2 Total energy costs and extent of air conditioning

Since naturally ventilated offices, designed to provide comfort even in warm weather, are nearly always cheaper to design and build, you should consider introducing natural ventilation into new buildings. If some air conditioning is needed, for example in noisy or polluted areas, in deep plan offices or offices with high internal heat gains, limit it to those areas where it is really required. In many cases, air conditioning can be avoided by careful design.

If you need air conditioning in your office, it need not lead to an excuse for high energy costs. Figure 2 also indicates that, although the most expensive buildings to run are fully air conditioned, some low energy cost buildings are also air conditioned — and some medium or high cost buildings have only partial or no air conditioning. Air conditioned buildings need not necessarily consume a lot more energy.

Thus the argument that energy costs are high because an office is air conditioned does not always hold, and the reasons for high costs should be investigated. Air conditioning cost could be high due to poor design of the system. Alternatively there may be scope for significant savings through improved control and maintenance.

Air Conditioning Costs

Where air conditioning is required, the costs should be controlled. The main costs associated with air conditioning arise from cooling, pumps and fans. Figure 3 shows a comparison of the costs of these services in air conditioned offices. Costs vary from £0.05 to over £1.10/ft², higher than any of the other individual components identified.

As opposite, the costs in the Good Practice Case Study offices are generally lower than in other offices, even where they are air conditioned. This demonstrates that full air conditioning systems can be run cheaply, for example through careful design and good maintenance.

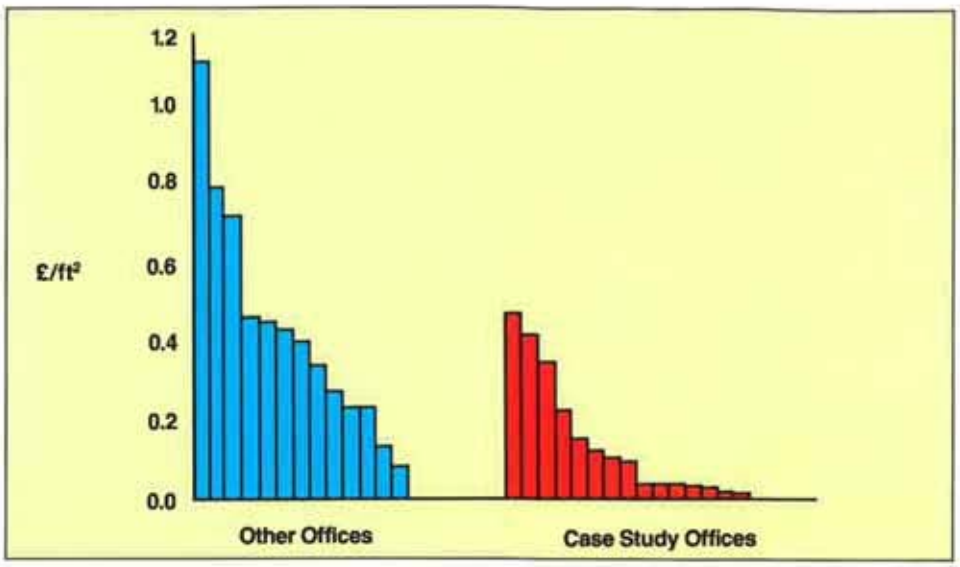

Figure 3 Air conditioning costs

Impact of Heating

The heating system is commonly perceived to be the major energy user in offices. Figure 4 shows a breakdown of costs into heating and other costs, indicating the proportion of total energy costs accounted for by the heating system.

The range of heating costs varies widely, from less than 5% to 76% of total energy costs. However, in 75% of offices, heating energy cost is less than one third of total energy costs.

The Good Practice Case Study offices generally have lower heating costs than other offices. Low heating costs are achieved through good insulation, effective control of the boiler and heating systems, and through use of high efficiency or condensing boilers.

Heating energy costs vary by a factor of 5 (from £0.10 to £0.50/ft²). This is considerably less than the factor of over 15 for total energy costs (£0.26 to £4.43/ft²). It appears that many occupiers have taken some steps to reduce heating energy costs, and that the Building Regulations have helped to limit the use of heating in offices. However in many offices, it is likely that there is still scope to reduce costs further.

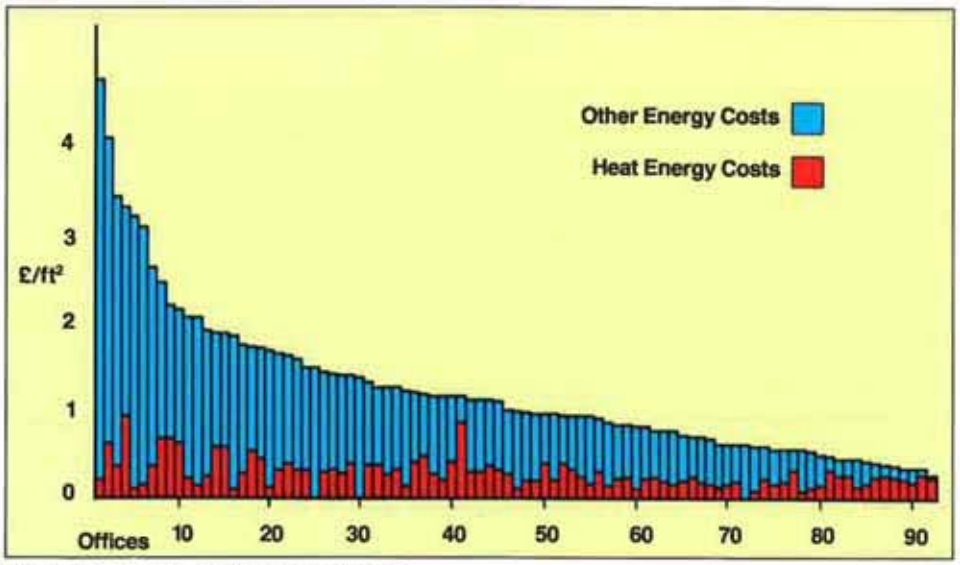

Figure 4 Heating and other energy costs

Impact of Lighting

Figure 5 shows the cost of lighting in a set of the offices, with variation between £0.05 and £0.59/ft². The majority of the Good Practice Case Study offices have lower lighting costs than the other offices.

Lighting is highly visible — lights left on unnecessarily are obvious and buildings with all lights burning during silent hours are attracting more and more public criticism.

Lighting costs are generally higher than heating costs, though they can be reduced more easily. There are some very simple ways to have an impact on lighting costs. For example, local switching is a simple, effective way of ensuring that lights can be switched off in areas where they are not required. New high efficiency lamps and reflectors can make major savings, particularly when used to replace old lamps which are on for long hours.

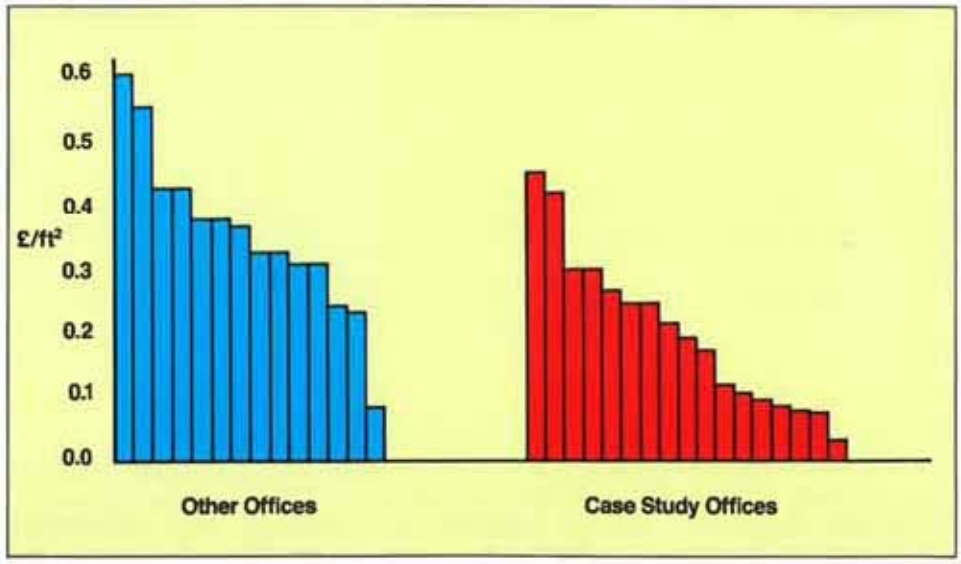

Figure 5 Lighting costs

Impact of Computer Suites

Some offices have computer suites housing large Mainframe computer systems. The energy cost of the computers plus the associated air conditioning costs can have a significant impact on total office energy costs. Figure 6 shows total energy costs for those offices in the sample that have a computer suite, divided between computer suite and other energy costs.

The graph demonstrates that computer suites can account for a significant proportion of total energy costs. However, the data shows that even where the energy consumption of computer suites is large, other energy costs can still be low. Therefore it should not be assumed, just because an office has a computer suite, that total energy costs will be high. As with air conditioning, having a computer suite should not be used as an excuse for poor total energy performance.

If you do have a computer suite, savings are possible in a number of areas. There is often considerable scope for savings from improved control and management of the computer air conditioning. Further, proper maintenance of plant will help to ensure optimum operational efficiency.

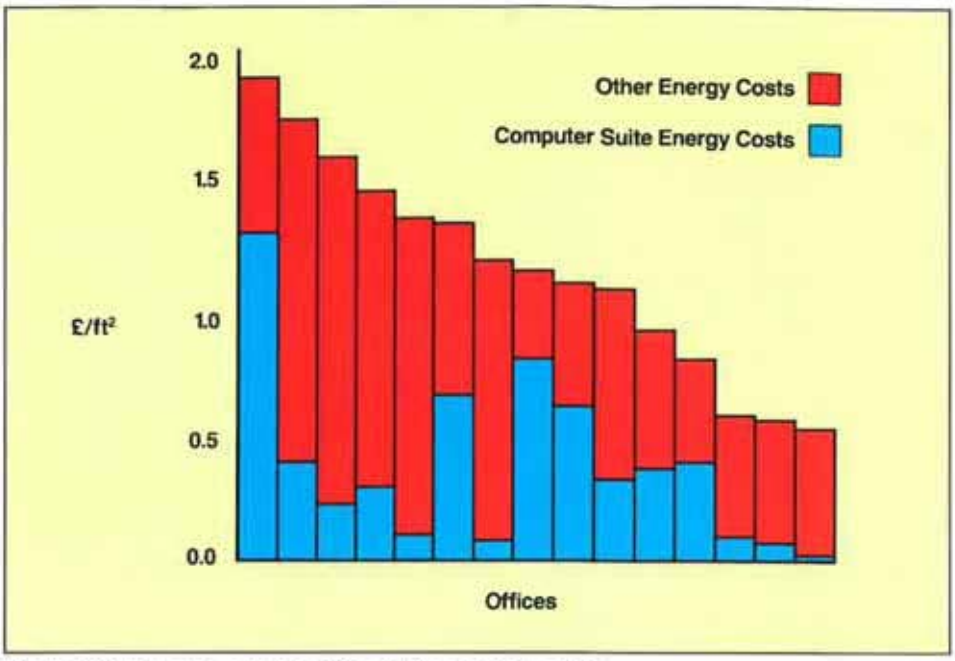

Figure 6 Total energy costs for offices with computer suites

What next

With energy use information derived from an energy audit, you can compare your energy performance with the range of others described in the graphs above. Armed with this information you should be able to:

- Identify your energy costs and where possible apportion them to the end uses as shown above
- Compare the various main energy uses and identify those priority areas in which action is required
- Take action to reduce energy costs

Remember — don't assume that just because your building is air conditioned that there is little you can do!

An energy efficient office has:

- **management commitment to energy efficiency**
- **staff awareness**
- **good housekeeping to avoid energy waste**
- **monitoring and targeting of energy use**
- **low energy lighting with good controls**
- **effective control systems on heating and air conditioning**

Short notes on measurement

In these comparisons, gross floor area is the total building area measured inside external walls, including foyers, stairways, toilets, corridors, meeting rooms etc.

All cost figures are based upon 1990 energy prices and include metering, maximum demand and unit changes where applicable.

Opportunities for Energy Saving

Savings can be achieved in a number of ways:

- Design new office buildings, or refurbishments, with energy efficiency in mind. Ensure that energy efficiency is in the specification.
- Alter the physical characteristics of a building to reduce its heat loss (eg. insulation, double glazing, draught stripping).
- Replace or upgrade the energy consuming equipment (eg. boilers, air conditioning plant, lighting) and controls to make it more efficient.
- Check whether the type of fuel used offers best value for money and that you are on the right tariff.

Some of these are easier to achieve than others and will allow you to make an immediate start to reducing your energy costs. These savings can create short term paybacks which provide the capital for more extensive changes.

Taking Action

Having collected the information you need, and identified areas in which action is required, there are a number of steps you should take:

- Prepare an action plan detailing how you are going to reduce your energy costs and identifying areas for action
- Appoint a person who will be responsible for energy efficiency
- Introduce housekeeping measures to reduce energy wastage (eg. lights left on, windows open with heating on)
- Monitor energy use and set targets for reducing it
- Obtain professional advice if you need it.

The EEO and BRECSU can provide advice which will help you to take action on energy efficiency in a number of ways:

- Providing detailed information on energy use in different types of office building
- Providing impartial case study reports on energy saving techniques
- Providing information on best practice and promoting it at seminars and workshops on energy efficiency

For further information on this or other buildings-related projects, please contact: Enquiries Bureau, Building Research Energy Conservation Support Unit (BRECSU), Building Research Establishment, Garston, Watford WD2 7JR. Tel No. 0923 664258. Fax No. 0923 664097.

For further information on industrial projects, please contact the Energy Efficiency Enquiries Bureau, Energy Technology Support Unit (ETSU), Building 156, Harwell Laboratory, Oxon OX11 0RA. Tel No: 0235 436747. Telex No: 83135. Fax No: 0235 432923.

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